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UTHM Herbs Garden Application Using Augmented Reality

Nurhakimah Azwani Md Najib[1], Norhalina Senan[1]*

[1]Faculty of Computer Science and Information Technology,
Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Johor MALAYSIA

Abstract: This application is develop to help guide the community in UTHM to recognize the herbs species. Nowadays, the existing method of conveying information about the herbs is by conventional method through a tagging card which is located nearby the herbs. This method is effective but there are no interesting features that can attract them to read the information about the herbs. The scope of this study covers the range of the target user and also the content of the application. The main target user is the community in UTHM which consist of students and staffs. This Herbs Augmented Reality Applications concentrated on the info of the herbs plant. This application will also be developed in English language. There will be 5 types of herbs which will be displayed. The herbs are turmeric, tongkat ali, asam gelugor, cengkih, and mas cotek. The platform for this application is mobile based platform. The modeling in this application will be in 3D which can capture their mind to be more attracted in using this application.

Keywords: Herbs, Augmented Reality, 3D

1. Introduction

Application on the augmented reality is still new within the community environment in Malaysia. One of the assimilation of the digital information with the user's environment in real time is the augmented reality. Users are provided of the technology-mediated immersive experiences in which real and virtual worlds are blended by Augmented Reality [1]. It is the technology that layers computer develop the improvement atop an existing reality in order to make it more meaningful through the ability to interact with it [2]. It is used to display score overlays on telecasted sport games and pop out 3D photo and many more on mobile devices. Along the advancement of the information technology era, there are variety of different applications that used augmented reality technology such as Pokemon Go, Amikasa and Smart Garden. The augmented reality technology have been applied in these applications for visualization information. In these applications, it allow the user to see the real world with the virtual objects superimposed upon to the visualization of the real world [3].

Other than that, augmented reality also have been applied in many kinds of industries and one of them is agriculture industry [4]. Recently, herbs have been one of the high demanding plant in agriculture industries especially in Malaysia. Therefore, there are various kinds of methods have been applied in order to preserve this herbs plant such as build a website on the information about the herbs

plant.

For that, Universiti Tun Hussein Onn Malaysia (UTHM) give an effort in preserving this herbs plant by developing the UTHM Herbs Garden. The purpose of building this Herbs Garden is to introduce the herbs plant to the UTHM community and give awareness about the importance of the herbs. Unfortunately, there are lack of information about the herbs provided in the UTHM Herbs Garden. Therefore, it is quite hard for UTHM community to get information about the herbs. Thus, in this study an augmented reality is proposed to convey the information about the herbs in UTHM Herbs Garden.

This augmented reality technology can help the community to easily gain access the information about the herbs. Thus, based on the information provided, the users can quickly memorize all the information about the plants from their mobile device as it is much more attractive compared to the conventional method which is using tagging card. For example, the users will see the 3D model and the information about the plant when they scan the marker which is located nearby the plant.

2. Literature Review

In this chapter, an overall review regarding an augmented reality on Herbs application for student in Universiti Tun Hussein Onn (UTHM) is explained. The issues that are being covered in this chapter is information about the herbs plant that plays the important role for the next generation to know about it and how the herbs information are delivered to the community. Next, the study about augmented reality technologies will be discussed in this chapter.

In order to have a vivid description of the project to be developed, the comparison between the propose application and the similar existing herbs applications is explained.

2.1 Herbs Garden

Herbs is a plant that dies back to the ground each year without forming woody stem tissues and a limits the number of plants [6]. Herbs can be categorized into six which are annuals, perennials, biennials, culinary herbs, aromatic herbs and medicinal herbs. All these categories have different functionality and purposes. For instance, culinary herbs such as chives, dill, thyme, basil and sage can be used for creating great tasting food, while aromatic herbs include lavender, lemon verbena, mint and rosemary can be used as perfumes, candles, and toiletries which provides a good smell [17]. Besides, herbs also can be used for medical purposes.

One of the effort that is done by UTHM is by creating a herbs garden which consists of many different kind of herbs. Figure 1 show the UTHM herbs garden. The information about the herbs in the garden is delivered through a tagging card at the herbs plant. Through this method people can easily obtain the herb's information by reading the information provided on the tagging card. Unfortunately, there are also some lacking or drawback though using this tagging card. As time goes by, the information written on the tagging card will slowly fade away and the tagging card will decayed which caused by the changes of the weather. Besides that, based to the interview session with the Subject Matter Expert (SME) of the herbs from Universiti Tun Hussein Onn Malaysia (UTHM), Prof. Madya Dr Alona Cuevas Linatoc that has been carried out formerly, it could be epitomize that the current method to introduce the herbs species might not be enough for the community in UTHM.

Figure 1: UTHM Herbs Garden

2.2 Augmented Reality

Augmented Reality (AR) is a field of computer research which deals with the combination of real-world and the computer-generated data [2]. It is a new technology that involves the overlay of computer graphics on the real world [3]. AR is within a more general context termed Mixed Reality (MR), which refers to a multi-axis spectrum of areas that cover Virtual Reality (VR), AR, telepresence and other related technologies. AR can be considered as a technology between VR and telepresence.

This Augmented Reality technology is user friendly and easy to interact with because it is used on mobile devices and it is easy as downloading the mobile application off the app store. Furthermore, Augmented Reality technology also provides the information in real time in a specific environment. Hence, Augmented Reality technology is proposed as a main platform in developing this application.

2.3 Computer Graphic

Computer graphic indicate to the technology dealing with the generation of pictures, design on a computer [10]. Computer graphics responsible for displaying art and image data effectively and meaningfully to the user. It is also used for processing image data received from the physical world. It is computer-generated image data created with help from specialized graphical hardware and software. Computer graphics is consists of 2 dimensional perspectives (2D) and 3 dimensional perspectives (3D) [10]. 2 dimensional modelling is the drawings which are conventionally represented elements constructed of architectural and archaeological nature at different scales of representation, consisting of plans, elevations and sections [10]. 3 dimensional modelling in the computer graphic is the process of creating a 3D representation of any surface or object manipulating polygons, edges and vertices in simulated 3D space.

2.4 Existing Application

The analysis of the existing applications will be explained in this chapter. The objective of analysing the existing applications is to determine the advantages and disadvantages of the application. Hence, from the analysis, the improvement and enhancement can be successful done based on user requirement. The application that will be compared are The Plant Life Balance [19] and Yates My Garden [20].

  i.   Plant Life Balance

Plant Life Balance application is designed to superimposing products into living rooms. The user only need to design a drawing on scientific research to help users kit out decorate their home. This application also provides the scientific articles to develop a plant life balance index. The index will show on how different plants absorb volatile organic compounds and how the plant can improve productivity and social behaviour. To place the plant in augmented reality, users need to snap a photo of the room with the smart phone and enter the number size of plants in the spaces.

Figure 2: Plant Life Balance application [19]

ii.   Yates My Garden

The Yates My Garden allows user to see how different plants will look in the garden. The tool lets users search for a particular plant type, before overlaying the plant of choice on user garden image. User can then reposition and scale the plant as well as saving or sending the image to friends. See how different plants will look in user garden using the interactive visualizer tool. Users also can re-position and scale the plant as well as saving the picture. Solve garden problems by searching user massive database of pests, diseases and weeds.
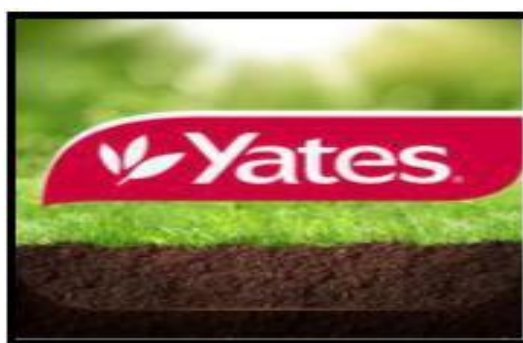
Figure 3: Yates My Garden [20]

iii.   Herbs Garden AR

This propose application are suitable for everyone. The technique used in this application for augmented reality is marker-based. The objectives of this application is to help guide the community to recognize the herbs species. The platform used is mobile device. It is also provided a detailed information, benefits and the usability of the herbs.

Table 1: Comparison between Similar Existing AR Application and Proposed Project

	Plant Life Balance	Yates My Garden	Herb Garden Augmented Reality (AR)
Target user	Suitable for everyone	Teenagers	Suitable for everyone
Augmented Reality Technique	Markerless	Markerless	Marker-based
Objectives	Just an entertainment and to create their own decoration plant in a room	Just an entertainment, create their own plants and design their own garden	To help and guide the community to recognize the herbs species
Platform	Mobile devices (android and iOS platform)	Mobile devices (android platform)	Mobile devices (android platform)

Table 1: (cont.)

	Plant Life Balance	Yates My Garden	Herb Garden Augmented Reality (AR)
Information	Provided only basic information or characteristics about the plant	Only provide the characteristics of the plants	Provide a detailed information, benefits and the usability of the herbs

Table 1 shows that two existing applications are concentrate only on the plant without providing the information about it. While, in Herb Garden AR, the plants is specific to herbs plant which will be contrast between the others existing applications. The objective for 'Plant Life Balance' and 'Yates My Garden' are quite identical which is to provide entertainment and create their own plant and decorate their garden respectively. The 'Herb Garden AR' objective is to help and guide the community to recognize the herbs species and their benefits. In the first application, Plant Life Balance provide only basic information or characteristics about the plant. For the second application, Yates My Garden only provide the characteristics of the plants. While in 'Herb Garden AR' application provided the graphic information about the herbs plant.

3. Methodology

The methodology used in this project development is elaborated. Instructional design models are suited in mostly all application. There are many different types of instructional design models, one of the model that has been widely adopted is the instructional systems development (ISD) model.

Figure 4: ADDIE Model

This model is generally referred as ADDIE model (Figure 4) as it consists of five phases namely Analysis, Design, Development, Implementation and Evaluation. The ADDIE model has been extensively used as a step by step procedural blueprint for the whole process of multimedia production [17]. This model is chosen for this project mainly because it is systematically enable designer to be aware of the interdependence of the elements of the total instructional system and make modification whenever it is necessary [18].

Table 2: Methodology Phase

Phase	Activity
Analysis Phase	Analysis phase is the first phase in ADDIE model. It is the most crucial step in the development process as the deliverable of this phase are the building blocks for all subsequent design and development activities in the future [19].
Design Phase	All the data or information collected from the analysis phase will be brought into

Table 2: cont

Phase	Activity
	the design consideration to ensure the design meets the needs of targeted users. Therefore, the goal of the project such as expected results, storyboard, content structure, flowchart, interface design, navigation design and type of interactivity would be specified in this stage.
Development Phase	The development phase is implemented after completion of the design. Development phase focuses on building the outcome of the design phase such as modelling, integration, animation and the coding. Building process is the mist time-consuming stage. Modelling and rendering of 3D model of the herbs plants would be carried out using Blender software.
Implementation Phase	All the compiling and coding is completed. The functionality of the application would be final checked by running it for several times. Any error would be immediately fixed. The exportation platform provided by Unity which is android system would be used to perform the implementation of the application. Alpha testing would be conducted by the developer to analyze the functionality before it is evaluated by target user in the next phase. The output at the end of this phase is an executed file .apk would be generated to be installed in mobile and few functioning markers are created.
Evaluation Phase	The evaluation phase is conducted with target users to get feedback regarding usability of the application so that the improvement can be made. The augmented reality application is tested by the community in UTHM. Interview session with the community of UTHM would be carried out regarding the user experience and constructive suggestions for the application. The results of this phase is obtaining the level of user acceptance towards this project.

4. Analysis and Design

In analysis phase involve the process of identifying the information needed to develop this application. There was a few process that requires early planning before the application is developed.

4.1 Idea Creating Application Phase

This phase is the process of idea creating which acquired from the observation and literature research before the application design and development begin. There are two activities will be done which is identify the user requirement and application. This step is taken to identify the necessities of the developer and users in order for the application to be developed according to the requirements. Table 4.1 describe about the idea of design this application before the design and development of the application.

4.2 User Requirement Analysis

User requirement is a process to identify the needed of user requirement to develop this application. The information of the user requirement is acquired from the observation that is done at the Herbs Garden in UTHM and the interview of subject matter expert (SME).

The purpose of the observation is to gain the details and useful information about the herbs plant. Based on the observation, it is found that the way to deliver the information of the herbs plant to the user are inefficient because the content of the herbs information that provided on the tagging card is difficult to read as time goes by, the information written on the tagging card will slowly fade away and the tagging card will decayed which caused by the changes of the weather.

From another observation, there is an augmented reality application has been applied in education purposes. It is found that the students are easily understood the learning by using augmented reality technology and encourage them in studies. Thus, this proposed application will be developed using AR

technology to convey information about the herbs in a more effective way. The interview also has been conducted to know the types of herbs and its benefits from the SME.

4.3 Application Requirement Analysis

Application requirement analysis is to identify the hardware and software requirement that applicable to develop this Herbs Garden AR application. Hardware used to develop this application are laptop, mobile device and mouse. Laptop that used have processor Intel Core i5-7200 2.5GHz with Turbo Boost up to 3.1GHz and the operating system is Windows 10. This laptop also have 4GB of memory and 1000GB of storage to easily in the processing process. The image display to the monitor used NVIDIA GeForce 940 MX with 2GB of graphic card.

The model of the mobile phone is Samsung J7. The dimensions for this model is 152.40 x 78.60 x 7.50 and it is also have 5.50-inch touchscreen display with a resolution of 720 pixels by 1280 pixels for the screen size. The memory and RAM for this model is 16 GB and 1.5 GB respectively. The operating system is Android 5.1. Meanwhile, the processor is 1.5 GHz Octa Core.

4.4 Concept Design

Concept design is an early phase of the design process, where the broad outlines of function and form of something are articulated. It includes the design of interactions, experiences, processes and strategies. It involves an understanding of people's needs - and how to meet them with products, services, & processes. Common artifacts of conceptual design are concept sketches and models. Figures 5, 6 and 7 shows the concept design of the application.
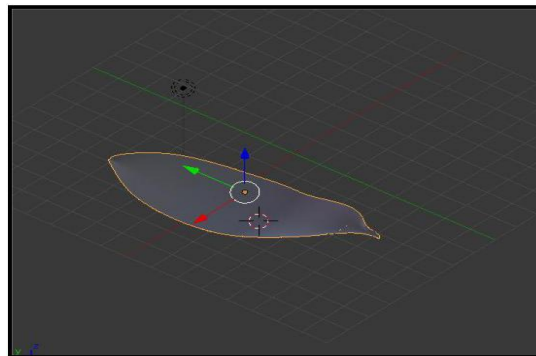
Figure 5: Leaf Design
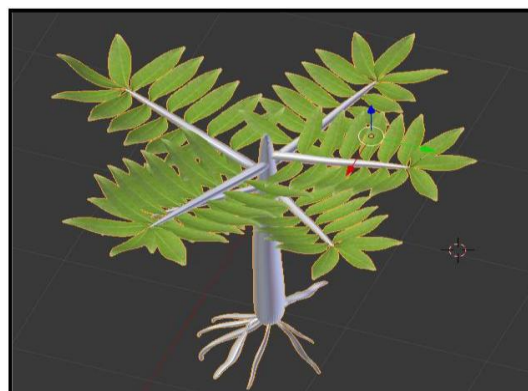
Figure 6: Leaf Design that have the texture
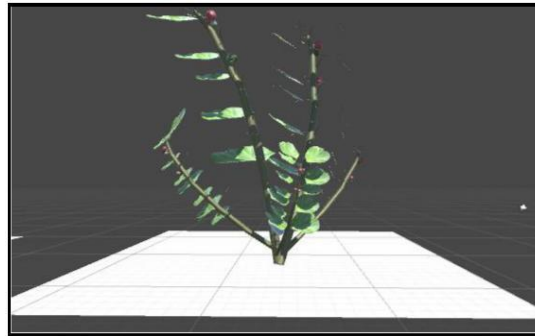
Figure 7: Herbs Model

Figure 8 shows the main page of Herbs Garden Application to the users. There are scan and about button. The scan button will bring the user to choose the model to scan. And in the scan button modules have info button that shows the information about the herbs plant. The about button is the information about the application.

Figure 8: Interface of Herbs Garden AR application

5. Implementation and Testing

Implementation phase are the development and integration of modules stage that are involved turn into one complete application. Next, the testing were done to the target users to confirm the usability of the application before through the production process. During the development of application stage, there are some activities has been done for the application development. The augmented reality (AR) environmental provision and modules development are one of the activities.

5.1 Development of AR Environment

This AR environment refer to the used of AR technology in this application. The AR technology that has been used are marker based type. This marker based is integrated by the Vuforia and this will be the database package which can be inserted in the Unity3D software to integrate with the Herbs Garden AR environment. There are three important elements to produce the AR environment for this application which is the installation of developer platform software, marker based and the AR camera.

5.2 Modules Development

Module in this application are develop using Unity3D software. Modules in this application is divided into two section which is info scan of the model AR and about this application. Integration model process in Unity are click on the Import Assets on Assets. Choose a fbx. file to invented in the Unity software. Then drag the object model in the Unity scene to set the position and it size. Figure 3.4 shows the integration 3D model process are built using Maya 2016 to the Unity software.
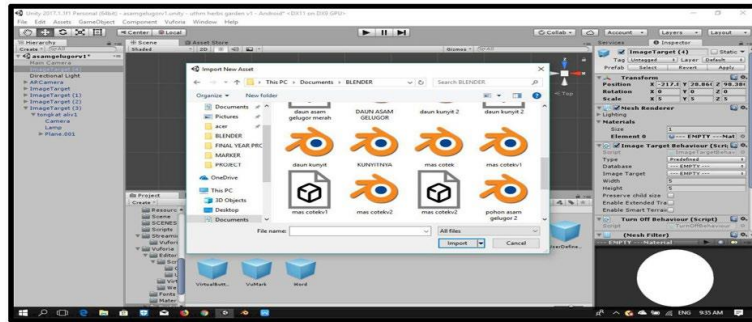
Figure 8: Integration of 3D model process into the Unity

5.3 Implementation Process

After the integration done, the implementation process will be carried out. In this phase involved two process which is the application publishing and the installation of the application in the mobile platform. *.apk files are already compiled and then will be invented to the mobile platform. The file is open and installed in the mobile platform. Next, the users can open the Herbs Garden Application.

5.4 User Manual

After the installation process are done, user can open the Herbs Garden Application in the application menu or in the home screen in the mobile device. This application take a few seconds to install the content of this application when the screen is display. Table 3 show the step in using the application.

Table 3: The entire steps of the application

Interface	Explanation
	1. The main page is display and SCAN button will enter to the scan of the models. 2. This SCAN button will bring the user to choose the model to scan. 3. This button will exit the application.
	1. There will appear two button which is INFO and . 2. This INFO will show the information about the herbs. 3. This button will be to the main page which is scan.

6. Conclusion

Hence, this application can help the community in UTHM to recognize the herbs plant and learn the benefits and also know the information of the herbs species. From this application could help to

maintain the species of the herb plant for the next generation. This application are develop with its own advantages and specialty. One of the advantages is the design of the interface and the functionality are concise and it is easy to use by the users. With the button provided it is easy to understand this application flow.

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